

Shasta Valley Groundwater Basin

- Groundwater Basin Number: 1-4
- County: Siskiyou
- Surface Area: 56,640 (82 square miles)

Basin Boundaries and Hydrology

The Shasta Valley Groundwater Basin is located along the west side of Shasta Valley and consists of Quaternary terrace deposits and alluvium. In the vicinity of Montague, the basin trends to the northeast and largely consists of older alluvium. The basin is bounded on the west by Paleozoic metamorphic and sedimentary rocks and Mesozoic intrusive rocks of the Klamath Mountains. On the east, from the southern extents of the basin north to Montague, the basin is bounded by a debris avalanche from ancestral Mount Shasta (Crandell 1984). Little Shasta Valley is bounded by the debris avalanche and Holocene Plutos Cave basalt to the south, and Eocene to Miocene volcanic rocks of the western Cascades to the east and north, which also separates Little Shasta Valley from the Shasta Valley Basin located north of Montague. Annual precipitation within the basin is estimated to be 13- to 25-inches, increasing to the south.

Hydrogeologic Information

Water-Bearing Formations

The primary water-bearing formation in the basin is Quaternary alluvium. Though the basin boundary is defined by alluvial deposits, the groundwater body of the entire valley appears to be hydrologically continuous with all geologic units (Mack 1960) including Plutos Cave basalt, the volcanic rocks of the western Cascades, and the ancestral Mount Shasta debris avalanche. A brief description of these units is provided below.

Holocene Alluvium. Alluvium underlies the majority of the basin and consists of silt and clay with beds of sand and gravel. Most wells yield water for domestic and stock uses. Irrigation wells obtaining water from alluvium are located mostly along the western margins of the valley. The thickness of unit may range up to 140 feet. Well yields range from 150- to 1,000-gpm. Specific capacity ranges from 2- to 67-gpm per foot of drawdown (Mack 1960).

The alluvium of Little Shasta Valley was derived from basic volcanic rocks of high calcium content resulting in the cementing of the subsoil into a hardpan. The alluvial strip from Gazelle to Grenada contains no hardpan (Mack 1960).

Pleistocene to Holocene Alluvium. Older alluvial deposits underlie the northern part of the valley north of Montague. The older alluvium includes gravels derived from metamorphic rocks of the Klamath Mountains and the Chico Formation. A hardpan layer of approximately one foot in thickness is present just below the surface, cemented primarily with iron minerals. In the vicinity of Montague, the older alluvium is up to 100 feet thick yielding sufficient water for domestic and stock uses.

The following geologic units are not located within the basin boundary but serve as significant groundwater storage and recharge areas within Shasta Valley. Groundwater has also been developed in these areas.

Holocene Plutos Cave Basalt. The Plutos Cave Basalt covers about 50 square miles in the southeastern part of the valley and forms a small segment of the basin boundary south of Little Shasta Valley. The flow is composed of black, vesicular olivine-rich augite basalt. The unit provides abundant water to wells and springs for irrigation and domestic uses with well yields up to 4,000 gpm, averaging 1,300 gpm. The groundwater appears to be present in the lava tubes, fractures and contacts between individual flows. Contacts between flows are vesicular and fractured. The unit may be as thick as 400 feet near the source at the south end of the valley.

Pleistocene Debris Landslide Deposit. The debris avalanche of ancestral Mount Shasta forms the basin boundary to the east from south of Gazelle to north of Grenada. The deposit covers about 180 square miles and consists of two lithologically distinct parts, the matrix facies and the block facies. The matrix facies consists of an unsorted and un-stratified mixture of pebbles, cobbles, and boulders in a compact sandy silt resembling a mudflow. The boulders and most cobbles are pyroxene andesite similar to rocks that make up the Mount Shasta volcano. In places the matrix incorporates the material from the underlying deposits, alluvial sand and gravel or lacustrine sediments. The fine grained part of the matrix includes sedimentary rock of the Hornbrook Formation, pulverized volcanic rock, and the alluvial and lacustrine sediments incorporated as the avalanche traveled across the valley floor. The matrix facies underlies flat areas between hills and extends beyond the outermost extent of the hills and mounds to the west side of Shasta Valley up to the upper end of the Shasta River gorge (Crandell 1984). The maximum exposed thickness of the matrix facies is about 100 feet near the Shasta River northwest of Edgewood. Some wells penetrate over 225 feet of material interpreted to be the matrix facies (Crandell 1984). The block facies forms the mounds, hills and ridges of the debris avalanche. The block facies includes individual andesite blocks, ranging in size from tens to hundreds of meters in maximum dimension, and masses of coherent but unconsolidated volcanoclastic deposits. Some hills consist of one or more large blocks of a single rock type with the slopes of most hills veneered with smaller rock fragments of varied rock types. Other hills are formed by lithologically dissimilar blocks that are parts of continuous stratigraphic successions transported in the same relative positions as their original sequence.

Eocene to Miocene Volcanic Rocks of the High Cascades. Volcanic rocks of the Cascades form the basin boundary to the north, south, and east for the portion of Shasta Valley Basin located north of Montague and also the boundary north and east of Little Shasta Valley. The older peaks of the high Cascades include Miller Mountain, Eagle Rock, and Goosenest and Willow Creek Mountain. The rocks are highly fractured, very permeable and are a major element of the groundwater storage reservoir and recharge mechanism in the valley. The individual flow units range in thickness from 10- to 50-feet and intermittently up to 100 feet. Individual well yields are quite

variable depending on the flow thickness and number of flow contacts intercepted as well as vertical fracturing.

Groundwater Level Trends

Analysis incomplete.

Groundwater Storage

The basin boundary has been delineated by the contact of the alluvial fill with the surrounding hard rock. Although some wells produce water from the alluvium, many wells also produce water from underlying volcanic rock. All units in the valley are hydrologically interconnected. The volcanic units provide storage and recharge to the basin and also serve as recharge and storage to areas outside of the basin. Due to the complexity of the region with respect to the extensive network of volcanic recharge/storage areas, the amount of groundwater in storage has not been estimated.

Groundwater Budget (Type B)

Estimates of groundwater extraction for the Shasta Valley Basin are based on a survey conducted by the California Department of Water Resources during 1991. The surveys included land use and sources of water. Estimates of groundwater extraction for agricultural and municipal/industrial uses are 50,000, and 2,210 acre-feet respectively. Deep percolation of applied water is estimated to be 18,600 acre-feet.

Groundwater Quality

Characterization. Groundwater in the basin is characterized as magnesium bicarbonate and calcium bicarbonate type water. Total dissolved solids range from 131- to 1,240-mg/L, averaging 406 mg/L (DWR unpublished data).

Impairments. Table Rock Springs has saline carbonated waters high in sodium, chloride, and boron. Some areas have high conductivity, ASAR, boron, and calcium. Locally high magnesium, iron, fluoride, nitrate, chloride, sodium, sulfate, hardness, and total dissolved solids concentrations occur within the basin.

Water Quality in Public Supply Wells

Constituent Group ¹	Number of wells sampled ²	Number of wells with a concentration above an MCL ³
Inorganics – Primary	5	0
Radiological	4	0
Nitrates	15	2
Pesticides	2	0
VOCs and SVOCs	2	0
Inorganics – Secondary	5	0

¹ A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).

² Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.

³ Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Characteristics

Well yields (gal/min)		
Municipal/Irrigation	Range: 2 – 1,200	Average: 273 (13 Well Completion Reports)
Total depths (ft)		
Domestic	Range: 20 – 1,183	Average: 156 (704 Well Completion Reports)
Municipal/Irrigation	Range: 40 – 450	Average: 164 (82 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	9 wells semi-annually
DWR	Miscellaneous Water Quality	15 wells biennial
Department of Health Services and cooperators	Miscellaneous Water Quality	24

Basin Management

Groundwater management:	Siskiyou County adopted a groundwater management ordinance in 1998
Water agencies	
Public	Montague Water CD, Grenada ID
Private	

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Errata

Changes made to the basin description will be noted here.